数理解析研究所講究録
第60巻 1968年 13-14

On The Centroid Method In Factor Analysis

(Abstract)

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The centroid method is a classical and popular method in factor extraction. Its mathematical(logical) structure, however, is not so well specified. D.N.Lawley(1) treated the efficiency problem of this method in the case of covariance matrix with known residual variances. In the present paper, we consider the case of correlation matrix from another point of view. For the details, we refer to Y. Asoo et al. (2).

In the first place, we consider the case of known communalities. In this case we may include the case whose communalities are uniquely determined by off-diagonal elements. For these cases the centroid method gives us the true structure, and the complete centroid method without adjustment also gives us the true structure in the case of positive communalities. Herewith we note that we could have the formal structure with communalities greater than 1 and/or less than 0 from the minimal-rank point of view. These are improper structures.

Secondly, we consider the case when we do not know true communalit -ies and the true number of factors is known. Since we do not know true communalities, we need the initial estimates of communalities ,and also several cycles of iterations. The first problem, then, is the convergence problem, and effects of initials to the final results must be inquired. Also, the optimum choice of the so-called sign change is the point.

In the case of known communalities, the sign-change can be done arbitrary. However, in the present case, it is not so. We use here the complete centroid method on this point. The usual complete centroid method and the complete centroid method without adjustment. With the former method, the final results are independent of initial estimates. However, they are not the true structures even when we use the true communalities as the initials. As noted above, on the contrary, we could get the true structures without iterations with the complete centroid method, using the true communalities as the initials. With the complete centroid method without adjustment, we may get the true structures, unless we estimate initials very low. This method might be superior to the usual complete centroid method in which we make the adjustment. These conclutions need further examinations.

REFERENCES:

(1) D.N.Lawley," A Statistical Examination Of The Centroid Method," Proc. Roy. Soc. Edin.A64, 1955, pp.175-189

(2) Y.Asoo," On The Centroid Method in Factor Analysis," Memoirs of The Faculty of Literature and Science, Shimane Univ., Natural Sciences, Vol.2, 1969 (with Y. Tumura)